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ISSLEDOVANIYA
KOSMICHESKOGO PROSTRANSTVA
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TABLE OF CONTENTS

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P R E F A C E

The first All-Union Conference on Space Physics took place in Moscow from 10 to 16 June 1965. Its main problem consisted in drawing a balance sheet of investigations conducted mainly with the help of rockets and artificial Earth's satellites.

The first in the World Earth's artificial satellite was launched in USSR on 4 October 1957. It laid the basis for direct human penetration into the depth of the Universe. Since then rocket flights to the Moon were materialized, piloted spaceships-satellites were launched and man's egress into space was achieved. These successes belong in the first place to our country. With the aid of the perfect sputniks of the 'Cosmos' and 'Electron' series and also other cosmic devices our scientists succeeded in obtaining numerous new and interesting results.

Nearly 100 reports (most manuscripts of which having been received in October-November 1964) were contributed. They encompassed most of the subdivisions of the multiple-branch area of space physics: upper atmosphere, ionosphere, radiation belts, interaction of solar corpuscular streams with the geomagnetic field, solar physics and physics of cosmic rays.

A series of experimental and theoretical reports drew the balance sheet of investigations of the Earth's upper atmosphere, its structure, dynamics and chemical composition.

Some of them were devoted to the study of infrared radiation of the Earth as well as of the upper atmosphere. The stratified distribution of atmosphere's infrared radiation intensity, heretofore unknown, was revealed in the 0.4 — 40 mk region of the spectrum with maxima

at 260, 420 and 500 km heights. Interesting data on lower atmosphere luminance and on the results of its analysis, obtained during the flights of spaceships Vostok and Voskhod, were communicated in reports drafted with the participation of cosmonauts Tereshkova-Nikolayeva and K. P. Feoktistov. It was assumed on the basis of these data that a dust cloud exists around the Earth at an altitude of ~ 19 km.

The investigations of the ionosphere with the aid of mass-spectrometers, various types of probes and by radiomethods provided new information on the structure of the ionized regions of the outer ionosphere and on the electromagnetic events taking place in it. It was established, that above 1000–1200 km, the ionosphere consists mainly of protons — ionized hydrogen atoms. The ionized helium, earlier revealed in other experiments in the 700–1000 km altitude range, was observed in 1964 in insignificant amounts only, with the help of the scientific station Electron. During the examination of data of investigations in coherent frequencies emitted from AES, several maxima of electron concentration in the outer ionosphere were detected for a prolonged period of time; these are apparently conditioned by the complex horizontal-irregular structure of the ionosphere, by the dynamics of ionized particles, by plasma oscillations and similar phenomena. The mean altitude dependence of electron concentration in the outer ionosphere has been obtained; it does not reveal any peculiarities in the 1000–2000 km altitude range, earlier noted in other works.

Several reports were devoted to the theoretical consideration of AES interaction with the ionosphere. The theory of kinetic flow past bodies in the plasma plays an important part in the investigations with the aid of AES. It allows to study the effects occurring in the vicinity of the body. Without accounting for these effects (angular distribution of particles, influence of the electric and magnetic fields) no correct interpretation of results is possible for a number of parameters of the unperturbed plasma. Friction of electromagnetic nature is also becoming noticeable at heights from 700 to 800 km and higher. The subsequent study of plasma stability in the vicinity of a moving body is important, just as is the creation of probe theory, taking into account the magnetic field.

Various results of measurements of the structure of the magnetosphere, radiation belts, Earth's magnetic field and corpuscular streams were reviewed in numerous reports. From the works presented it may be seen that there exists a close link between the behavior of radiation belts and a series of geophysical events, such as the variations of the Earth's magnetic field, the behavior of the polar ionosphere etc. ; at the same time, the amount of the experimental data presently available is still insufficient in spite of all its abundance and does not allow yet to compose a specific picture about radiation fields, radiation fluxes, surrounding the Earth. No somewhat complete and closed theory of these events exists as yet. The results of the various experiments still do not quite coincide and at times they diverge significantly.

Apparently the question of the nature and mechanisms of radiation belt formation will be reexamined in the very near future. An active trend is observed in trying to explain the structure of the belts by accounting for the dynamics of incident plasma fluxes in the Earth's magnetic field, of particle capture in the geomagnetic trap and their subsequent acceleration. From the energetic viewpoint such patterns do not encounter contradictions.

The fluxes of electrons, encountered in various experiments beyond the limits of the radiation belts at magnetosphere boundary, are noted in radiation zones trapped in the geomagnetic trap. This constitutes in some fashion the electron component of the plasma incident on Earth. The experimental data just as the general physical pattern of magnetosphere structure do not provide, however, any basis for the assumption of existence of still another, so-called outermost radiation belt.

The results of investigation of Sun's X-radiation, reported at the conference, create a rather clear picture about its properties and the energetic spectrum of this radiation in the period of the quiet Sun. A series of new data characterize the bursts of this radiation and their relationship with other events.

It is interesting that during the flares of cosmic rays, generated in the Sun, their intensity in the interplanetary medium increases at times even by hundreds and thousands.

Measurements of the intensity of cosmic radio emission on the scientific station Electron in the low-frequency wave band (725 and 1525 kc/s), which can be achieved only aboard satellites, lead to the detection of a series of interesting properties of this radiation, the nature of which will become understandable only in the future.

Investigation of cosmic rays on satellites allowed to obtain data on the chemical composition of their nuclear component, on the intensity of cosmic rays at various distances from the Sun etc. The possibility of study in the experiments of AES of processes induced by particles of very high energy, present in the composition of cosmic rays, and of search for fundamental elementary particles, in particular those forecast by the theory of the so called (...?....)*, that is, particles with a charge of one third to two-thirds of the electric charge of an electron are considered in one of the reports as one of the fundamental problems of future investigations.

The problems of meteorological satellites, of radiational security of space flights, of radiowave propagation to distances in millions of kilometers or at communication with cosmonauts, and a series of other questions, were all subjects of special reports.

During the latest years the scale and the span of investigations in the field of space physics have risen very strongly. At the same time, it is already impossible, at present, to be satisfied with the scale of standing investigations. The requirement is felt to improve the quality of experiments, to set up complex experiments and go deep into their analysis. Required also is an accelerated development of planetary investigations with the aid of rockets, the broadening of experiments for the study of the recently discovered galactic γ -radiation. Of importance are the studies of spectra of interplanetary medium's and planet's natural electromagnetic radiation, and the solution of numerous other problems, which indeed are every day brought forth by space science. Search for more perfect and final theories of events studied is felt to be indispensable. The abundance of information which we obtain from experiments with the aid of satellites and rockets, provides the basis to believe that the time

* [equivalent of "kvarka" could not be found in any glossary or dictionary available]. — *quark?*

approaches, when one may be ready to undertake the creation of a new, more up-to-date and complete theory of Earth's atmosphere and ionosphere formation, to understand the dynamics of the interplanetary plasma, to create the theory of formation of the magnetosphere and of radiation belts and to explain the nature of numerous, most interesting events revealed in the Cosmos.

**** END OF PREFACE ****

TABLE OF CONTENTS

PREFACE	3
Introductory word by the Chairman of the Commission for the Investigation and Utilization of Cosmic Space, A. A. Blagonravov	7
 <u>I. UPPER ATMOSPHERE OF THE EARTH</u> 	
V. I. Krasovskiy. - Some problems of upper atmosphere physics and of physics of the interplanetary space... 11	11
V. V. Mikhnevich. - Temperature and density of the atmosphere according to the results of measurements by means of altitude geophysical stations ...	
M. N. Izakov. - Some questions related to the study of structure of the upper atmosphere	30
R. S. Zhanturov. - Daily variations of density, pressure and temperature in the atmosphere	39
M. Ya. Marov. - On the dynamic character of atmosphere density in the 200 - 300 km altitude range	41
A. D. Danilov. - On the composition of the atmosphere in the 100 - 200 km region	48
V. G. Kurt. - To the question of total amount of neutral hydrogen in the upper atmosphere of the Earth	51
B. N. Trubnikov. - To the question of utilization of orbital data of AES for the determination of wind velocity in the thermosphere	51
A. E. Mikirov. - Estimate of ozone concentration in the 44 - 102 km range from data obtained during night launchings of geophysical rockets (theses)	56
A. I. Ivanovskiy. - Aerodynamic of manometers and mass-spectro- meters, installed on rockets and satellites ..	56
G. V. Rozenberg, V. V. Tereshkova. - Stratosphere aerosol by measurements from spaceship ..	61
K. P. Feoktistov, G. V. Rozenberg <u>et al.</u> - Some results of opti- cal observations from ss. "Voskhod"	62
S. M. Poloskov. - Some results of rocket investigations of the Earth's upper atmosphere for the period 1960 - 1964 (theses)	64
A. I. Lebedinskiy, D. N. Glovatskiy <u>et al.</u> - Infrared spectropho- tometry of Earth's thermal radiation	65

A. I. Lebedinskiy, V. A. Krasnopol'skiy <u>et al.</u> .- Investigation of radiation of the terrestrial atmosphere in the visible and ultraviolet regions	77
T. M. Tarasova. - Natural radiation of the atmosphere (theses) ..	89
M. N. Markov, Ya. I. Merson, M. R. Shamilev.- Investigation of the angular distribution of Earth and terrestrial atmosphere radiation from geophysical rockets and balloons	90
P. A. Bazhulin, A. V. Kartashev, M. N. Markov.- Angular and spectral distribution of Earth's radiation in the infrared region of the spectrum	94
M. S. Malkevich, V. I. Tatarskiy.- Determination of temperature and humidity of the terrestrial atmosphere from measurements of Earth's radiation from satellites	104
S. A. Kaplan, V. G. Kurt.- Scattering of $O\ I(\lambda\ 1300\ \text{\AA})$ emission in the Earth's upper atmosphere (theses)	111
M. N. Markov, Ya. I. Merson, M. R. Shamilev.- Upper atmosphere layers emitting in the infrared region of the spectrum	112

II. - EARTH'S IONOSPHERE

Ya. L. Al'pert, V. M. Sinel'nikov.- On the altitude-temporal distribution of electron concentration and irregular formations of the outer ionosphere .	123
V. A. Misyura, G. K. Solodovnikov <u>et al.</u> .- On certain results of ionosphere investigations with the aid of AES and geophysical rockets	138
L. M. Yerukhimov, N. A. Mityakov, E. E. Mityakova. - Investigations of the ionosphere by method of ground reception of AES radio emission.....	147
V. V. Afonin, T. K. Breus, G. L. Gdalevich <u>et al.</u> .- Brief review of results of physical experiments conducted in the ionosphere from AES Cosmos-2	151
B. N. Gorozhankin, V. A. Rudakov.- Results of ionosphere investigations with the aid of rockets and satellites in the period 1960-1964.	168
V. V. Bezrukikh, K. I. Gringauz.- The outer region of Earth's ionosphere (2000 to 20 000 km)	177
T. K. Breus, G. L. Gdalevich.- Electron and ion temperatures in the ionosphere (theses)	184
T. V. Kazachevskaya, G. S. Ivanov-Kholodnyy.- Rocket data on the behavior of electron concentration in the ionosphere at 100 - 300 km heights.....	189

V. G. Istomin.- Composition of the outer atmosphere of the Earth according to measurements on AES Electron ...	192
O. L. Vaysberg, F. K. Shuyskaya. - On an anomaly in pitch-distributions of electrons	203
T. M. Mulyarchik. Variations of the soft component of the energy spectrum of electrons	205
V. V. Temnyy.- Spatial distribution of various groups of trapped corpuscles from data of AES Cosmos-3 and -5	209
L. A. Antonova, T. V. Kazachevskaya.- Measurement of fluxes of soft electrons in the upper atmosphere to 500 km height ..	214
G. S. Ivanov-Kholodnyy, A. D. Danilov.- Variations in the ion content of the atmosphere at 100 - 200 km (theses)	216
F. I. Berbasov, T. S. Kerblay <u>et al.</u> - Peculiarities of communication with spacecraft in short waves	220
M. A. Kolosov, O. I. Yakovlev, A. I. Yefimov.- On the propagation of radiowaves in the interplanetary and near-solar space	227
V. I. Aksenov.- On passage of VLF electromagnetic waves through the ionosphere plasma (theses)	233

III.- INTERACTION OF AES WITH THE IONOSPHERE

Ya. L. Al'pert.- Interaction of moving bodies with a plasma (Introductory remarks)	237
A. V. Gurevich, A. M. Moskalenko. Deceleration of bodies moving in a rarefied plasma	241
Yu. M. Panchenko.- Asymptotics of the wake of a body moving in a rarefied plasma	254
A. M. Moskalenko.- Structure of the perturbed zone in the vicinity of a cylindrical body in a plasma	264
L. L. Goryshkin, A. N. Dyukalov.- Strengthening of the external electric field on the surface of a large body in the ionosphere	267
M. V. Maslenikov, Yu S. Sigov.- Discrete model of matter in the problem of interaction with rarefied plasma of fast-moving bodies (theses)	270
G. L. Gdalevich, I. M. Imyanitov.- Electric field in the ionosphere according to direct measurements on geophysical rockets	271

IV.- CORPUSCULAR STREAMS
AND THEIR INTERACTION WITH THE GEOMAGNETIC FIELD,
THE MAGNETOSPHERE AND THE EARTH'S RADIATION BELTS

S. N. VERNOV.- State of studies of the Earth's radiation belts and perspectives	277
V. D. Pletnev, G. A. Skuridin <u>et al.</u> - Processes of breakthrough into the magnetosphere, capture and acceleration of particles of solar flux and their role in the geomagnetic trap	285
B. A. Tverskoy.- Anomalous diffusion of charged particles in the Earth's radiation belts	314
A. I. Yershkovich, V. P. Shabanskiy, A. E. Antonova.- On the formation of radiation belts as a result of particle drift in the depth of the magnetosphere	326
K. I. Gringauz.- Interplanetary plasma (Solar wind). (Theses)	334
K. I. Gringauz, Sh. Sh. Dolginov, V. V. Bezrukikh <u>et al.</u> - Comparison of simultaneous measurements of the magnetic field and of fluxes of positive ions inside the Earth's magnetosphere conducted on AES Electron-2	336
Sh. Sh. Dolginov, E. G. Yeroshenko, L. N. Zhuzgov.- Investigation of the Earth's magnetosphere in the radiation belt region ($3-6R_E$) in February-April 1964	342
E. G. Yeroshenko.- Investigation of the Earth's magnetosphere at the distance of $7-11.7 R_E$ by AES Electron	356
Yu. D. Kalinin, E. I. Mogilevskiy.- Structure of the solar corpuscular stream and its interaction with the magnetosphere of the Earth	368
S. N. Vernov, V. V. Mel'nikov, I. A. Savenko <u>et al.</u> - Registration of charged particles with energy $0.1-10$ kev by an electrostatic spherical analyzer	381
Yu. I. Gal'perin.- Physical pattern of artificial radiation belt appearance at American altitude thermonuclear explosion of 9 July 1962	388
P. V. Vakulov.- Investigation of radiation on AES Cosmos-17 (th)..	393
S. N. Vernov, A. E. Chudakov, P. V. Vakulov <u>et al.</u> - Results of investigation of the geometric disposition and particle content of Earth's radiation belts according to data of AES Electron-1 and -2.	394
A. D. Bolyunova, O. L. Vaysberg, Yu. I. Gal'perin <u>et al.</u> - Preliminary results of investigations of corpuscles with the aid of AES Electron-1	406

V. V. Bezrukikh, K. I. Gringauz <u>et al.</u> .- On the possible existence of an electron component in the outer radiation belt and its variations	418
S. N. Kuznetsov, E. N. Sosnovets, V. G. Stolpovskiy.- Temporal variations of the Earth's outer radiation belt by the data from AES Electron series	420
S. N. Vernov, A. E. Chudakov, P. V. Vakulov <u>et al.</u> .- Irregular high-energy electron fluxes near the boundary of Earth's radiation belts	425
S. N. Vernov, V. E. Nesterov, N. F. Pisarenko <u>et al.</u> .- Investigation of Earth's outer radiation belt at small altitudes during flights of ss and AES Cosmos from 1960 to 1963	434
V. E. Nesterov, N. F. Pisarenko, I. A. Savenko <u>et al.</u> .- Investigation of the inner and of the artificial radiation belts of the Earth at low altitudes from 1960 through 1964.	448
S. N. Vernov, L. L. Lizutin, A. N. Charakhch'yan <u>et al.</u> .- The outer radiation belt and the X-ray bursts in the stratosphere	454
S. N. Vernov, I. A. Savenko <u>et al.</u> .- Some results of measurements in the outer radiation belt from AES Cosmos-41	460
G. A. Kirdina, Yu. M. Kulagin <u>et al.</u> .- Investigation of radiation intensity in the Earth's radiation belts on AES Cosmos-17 (theses)	464
I. A. Savenko, P. I. Shavrin, L. V. Tverskaya. - To the question of corpuscular radiation in near-equatorial regions at small altitudes (theses)	465
M. V. Samokhin.- Solar wind interaction with the geomagnetic field (theses)	466
Yu. S. Sigov.- On the structure of the boundary layer between the rarefied plasma and the magnetic field (th)..	467
K. I. Gringauz, M. Z. Khokhlov.- Outermost belt of charged part.....	467

V. - COSMIC RAYS

N. L. Grigorov, I. D. Rapoport <u>et al.</u> .- Problems and perspectives of cosmic ray particle study with high and low energies (theses)	484
V. L. Ginzburg, L. V. Kurnosova, L. A. Razorenov <u>et al.</u> .- Some problems and perspectives of investigations of primary cosmic rays	486

L. V. Kurnosova, L. A. Razorenov <u>et al.</u> - Experimental investigations of the composition of primary cosmic rays	501
S. N. Vernov, P. V. Vakulov, V. I. Zaytsev <u>et al.</u> - Investigation of primary cosmic radiation on AES Electron-2 and -4	502
R. N. Basilova, V. E. Nesterov, N. F. Pisarenko <u>et al.</u> - Investigation of cosmic rays during the flights of spaceships and AES Cosmos series	506
S. I. Avdyushin, N. K. Pereyaslova, I. E. Petrenko. Intensity of ionizing radiations according to measurements on Zond-1 (theses)	510
S. I. Avdyushin, R. M. Kogan, M. N. Nazarova <u>et al.</u> - Registration of cosmic rays on AES Cosmos-17 (theses)	511
Yu. G. Shafer, B. N. Kruzhevskiy <u>et al.</u> - Effect of solar and geophysical events in the primary radiation, registered on AES Cosmos-19 (theses)	513
Ya. L. Blohk, L. I. Dorman, L. V. Kurnosova <u>et al.</u> - Some results of investigation of the nuclear component of cosmic rays on AES Electron-2	514

VI. - SUN

S. L. Mandel'shtam.- X-ray radiation of the Sun (theses)	531
I. A. Zhitnik, V. V. Krutov <u>et al.</u> - Sun's image in the far ultraviolet (theses)	533
I. P. Tindo.- Measurement of intensity of Sun's X-radiation with the aid of the space station Electron-2.....	533
A. N. Charakhch'yan, T. N. Charakhch'yan.- Generation of cosmic rays in the Sun	547

VI.- VARIOUS QUESTIONS

K. Ya. Kondrat'yev.- Interpretation of radiation data from meteorological satellites	555
V. E. Nesterov, N. F. Pisarenko, I. A. Savenko <u>et al.</u> - Problem of radiation security of cosmic flights	568
T. N. Nazarova.- Investigation of meteor matter	572
V. G. Kurt.- Measurement of scattered L-radiation in the vicinity of the Earth and in interplanetary space	576

E. A. Benediktov, G. G. Getmantzev, N. A. Mityakov <u>et al.</u> .- Results of measurements of radio emission intensity in the frequencies of 725 and 1525 kc/s with the aid of apparatus installed on AES Electron-2	581
Sh. Sh. Dolginov, V. I. Nalivayko <u>et al.</u> .- Experiments on the World Magnetic Survey Program	606
P. V. Vakulov.- On the effect of satellites on the radiation intensity in radiation belts	615

THE END

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